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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/086,710	03/04/2002	Hideyuki Kazumi	520.35833VV5	3298

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EXAMINER
HASSANZADEH, PARVIZ

ART UNIT	PAPER NUMBER
1763	

DATE MAILED: 11/14/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

T.D

Office Action Summary	Application No.	Applicant(s)	
	10/086,710	KAZUMI ET AL.	
	Examiner	Art Unit	
	Parviz Hassanzadeh	1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 July 2002* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-11* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *04 March 2002* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☒ Certified copies of the priority documents have been received in Application No. *08/979,949* .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *3,4* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Specification

The disclosure is objected to because of the following informalities: it is suggested to revise the text on page 3, lines 4-5 as being vague. Appropriate correction is required.

The abstract of the disclosure is objected to because it does not reflect the subject matter of the claimed embodiment. Correction is required. See MPEP § 608.01(b).

Drawings

The drawings are objected to under 37 CFR 1.83(a) because they fail to show "a plate made of a conductor or semiconductor placed on an inner side of the upper face of the vacuum chamber wherein the plate is coupled to an RF, DC or ground" as described in the claims. Any structural detail that is essential for a proper understanding of the disclosed invention should be shown in the drawing. MPEP § 608.02(d). A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-2, 4-7 and 9-11 are rejected under 35 U.S.C. 102(b) as being anticipated by Collins et al (US Patent No. 5,556,501).

Collins et al teach a plasma processing apparatus (Figs. 1, 2) comprising:

a *coil antenna* 30 for generating a plasma;

a *radio-frequency power source and matching network* 31 for supplying radio-frequency electric power to the antenna (column 8, lines 4-15);

an vacuum chamber upper plasma generating portion 16A (*vacuum chamber enclosing a plasma generating portion*) (column 7, lines 19-48);

a Faraday shield 45 comprising surfaces 46-49 disposed around the walls 17W of the cylindrical source in order to ensure plasma uniformity by reducing capacitive coupling (column 15, lines 3-58);

a *gas supply unit* (not shown) connected to a gas distribution ring 51 for supplying a gas into the chamber (column 7, line 51 through column 8, line 3 and column 9, line 64 through column 10, line 11);

a wafer support 32C (*sample stage*) for supporting a wafer 5; and

an AC power supply 42 (a radio-frequency power source) for applying a bias RF frequency to the wafer support 42 (column 11, lines 41-60),

wherein, as shown in Fig. 1, the upper section 16A defined by a (cylindrical) dome 17 comprising a cylindrical wall 17W covered by a *top 17T* at the upper face and supported on a processing chamber top wall 13 at its lower face (*the upper face has a smaller area than that of a lower face and the upper face is flat*) (column 7, lines 19-48); and

wherein the apparatus further includes a third electrode 17T disposed in the upper section 16A, the third electrode may be floating, grounded or connected to an RF power source 40 as shown in Fig. 1, and the third electrode may have various configuration and can be made of various material such as aluminum (*conductor*) or silicon (*semiconductor*) (*a plate made of a conductor or semiconductor is placed on an inner side of the upper face of the vacuum chamber wherein an RF voltage is applied to the plate or the plate is grounded*) (column 7, lines 19-38 and column 21, line 43 through column 22, line 26).

Further regarding claims5, 10, 11 : vacuum chamber includes an upper plasma generating portion 16A and a lower plasma processing section 16B as shown in Fig. 1 wherein the plasma generation section having a smaller width than the lower plasma processing section.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later

invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 3 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Collins et al (US Patent No. 5,556,501) in view of Gorin (US Patent No. 4,464,223).

Collins et al teach all limitations of the claims as discussed above except for a DC voltage source is coupled to the conductive plate (*third electrode*).

Gorin teaches a plasma processing apparatus wherein an electrode 14 may be coupled to an RF power source 36, to a DC power source 42, or being grounded through a series circuit 44 as shown in Fig. 2. use of the DC power supply allows the amount of DC biasing induced by the plasma to be changed independently of pressure or power (column 3, lines 4-63).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to implement the bias power mechanism including the DC power source as taught by Gorin et al in the apparatus of Collins et al in order to control the amount of bias independently of pressure or power.

Claims 1-2, 4-7 and 9-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Li et al (US Patent No. 5,772,771) in view of Collins et al (US Patent No. 5,556,501).

Li et al teach a plasma processing apparatus (Fig. 1) comprising:

a *coil antenna* 8 for generating a plasma;

a *radio-frequency power source 10* for supplying radio-frequency electric power to the antenna;

a housing 4 (*vacuum chamber enclosing a plasma generating portion*);

a *gas supply unit* (not shown) connected to a gas distribution nozzle 34 for supplying a gas into the chamber;

a substrate support 14 (*sample stage*) for supporting a substrate 20; and

a bias radio-frequency power source 22 for applying a bias RF frequency to the wafer support 14,

wherein, as shown in Fig. 1, the housing 4 including a (truncated) dome 6 surrounded by the coils 8 and having its upper face covered by a top 25 (*flat and circular*) and its *bottom face* sitting on a processing chamber side wall 30 (*the upper face has a smaller area than that of a lower face and the upper face is flat*); and

wherein the apparatus further includes a top 25 acting an anode and is electrically biased by a second RF power source 26 (*a plate made of a conductor or semiconductor is placed on an inner side of the upper face of the vacuum chamber wherein an RF voltage is applied to the plate*) (column 3, lines 20-47).

Li et al fail to teach a Faraday shield provided around the plasma generating portion.

Collins et al teach a plasma processing apparatus (Figs. 1-2) including a Faraday shield 45 in order to produce a plasma mainly inductively rather than capacitively (column 15, lines 3-58).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to employ the Faraday shield as taught by Collins et al in the apparatus of Li et al in order to generate a plasma mainly inductively.

Collins et al further teach a plasma processing apparatus (Figs. 1-2) including a third electrode 17T disposed in the upper section 16A, the third electrode may be floating, grounded

or connected to an RF power source 40 as shown in Fig. 1, and the third electrode may have various configuration and can be made of various material such as aluminum (*conductor*) or silicon (*semiconductor*) (*a plate made of a conductor or semiconductor is placed on an inner side of the upper face of the vacuum chamber wherein an RF voltage is applied to the plate or the plate is grounded*) (column 7, lines 19-38 and column 21, line 43 through column 22, line 26).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to implement the bias mechanism including the grounding as taught by Collins et al in the apparatus of Li et al in order to enhance various processing characteristic including etch rate and plasma coupling (column 21, lines 60-67).

Further regarding claims 5, 10, 11: It was held in re Gardner v. TEC Systems, Inc., 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984) that where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device.

Claims 3 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Li et al (US Patent No. 5,772,771) in view of Collins et al (US Patent No. 5,556,501) as applied to claims 1-2, 4-7, 9-11 above, and further in view of Gorin (US Patent No. 4,464,223).

Li et al in view of Collins et al teach all limitations of the claims as discussed above except for a DC voltage source is coupled to the conductive plate.

Gorin teaches a plasma processing apparatus wherein an electrode 14 may be coupled to an RF power source 36, to a DC power source 42, or being grounded through a series circuit 44 as shown in Fig. 2. Use of the DC power supply allows the amount of DC biasing induced by the plasma to be changed independently of pressure or power. Grounding will change the electrode area ratio between a high frequency electrode 12 (plasma source) and a ground electrode 26 (return path) is changed (column 3, lines 4-63).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to implement the bias power mechanism including the DC power source as taught by Gorin et al in the apparatus of Collins et al in order to control the amount of bias independently of pressure or power.

Claims 1-2, 4-7 and 9-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lu et al (US Patent No. 5,904,778) in view of Collins et al (US Patent No. 5,556,501).

Lu et al teach a plasma processing apparatus (Fig. 9) comprising:

a *coil antenna* 72 for generating a plasma;

a *radio-frequency power source (not shown)* for supplying radio-frequency electric power to the antenna;

a plasma generating chamber defined by side wall 74 and a top wall 80 (*vacuum chamber enclosing a plasma generating portion*);

a *gas supply unit* (not shown);

a pedestal electrode 82 (*sample stage*) for supporting a wafer ; and

a bias radio-frequency power source 84 for applying a bias RF frequency to the wafer support 82,

wherein, as shown in Fig. 8, the housing comprising a truncated conical dome 70 having an RF inductive coil 72 wrapped around its outside, and a roof 80 (*an upper flat and circular face*), and a bottom side sitting on a processing chamber (*the upper face has a smaller area than that of a lower face and the upper face is flat*); and

wherein the top wall 80 is grounded (*a plate made of a conductor or semiconductor is placed on an inner side of the upper face of the vacuum chamber wherein the plate is grounded*) (column 11, line 15 through column 12, line 33).

Lu et al fail to teach a Faraday shield provided around the plasma generating portion and a magnetic field generating device (means).

Collins et al teach a plasma processing apparatus (Figs. 1-2) including a Faraday shield 45 in order to produce a plasma mainly inductively rather than capacitively, and.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to employ the Faraday shield as taught by Collins et al in the apparatus of Lu et al in order to generate a plasma mainly inductively.

Collins et al further teach a plasma processing apparatus (Figs. 1-2) including a third electrode 17T disposed in the upper section 16A, the third electrode may be floating, grounded or connected to an RF power source 40 as shown in Fig. 1, and the third electrode may have various configuration and can be made of various material such as aluminum (*conductor*) or silicon (*semiconductor*) (*a plate made of a conductor or semiconductor is placed on an inner side of the upper face of the vacuum chamber wherein an RF voltage is applied to the plate or the plate is grounded*) (column 7, lines 19-38 and column 21, line 43 through column 22, line 26).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to implement the bias mechanism including the bias RF power source as taught by Collins et al in the apparatus of Lu et al in order to enhance various processing characteristic including etch rate and selectivity (column 22, lines 1-26).

Further regarding claims 5, 10, 11: It was held in re Gardner v. TEC Systems, Inc., 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984) that where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device.

Claims 3 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lu et al (US Patent No. 5,904,778) in view of Collins et al (US Patent No. 5,556,501) as applied to claims 1-2, 5-7, 10-11 above, and further in view of Gorin (US Patent No. 4,464,223).

Lu et al in view of Collins et al teach all limitations of the claims as discussed above except for a DC voltage source is coupled to the conductive plated.

Gorin teaches a plasma processing apparatus wherein an electrode 14 may be coupled to an RF power source 36, to a DC power source 42, or being grounded through a series circuit 44 as shown in Fig. 2. Use of the DC power supply allows the amount of DC biasing induced by the plasma to be changed independently of pressure or power. Grounding will change the electrode area ratio between a high frequency electrode 12 (plasma source) and a ground electrode 26 (return path) is changed (column 3, lines 4-63).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to implement the bias power mechanism including the DC power source as taught by Gorin et al in the apparatus of Collins et al in order to control the amount of bias independently of pressure or power.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The following arts disclose plasma processing apparatus including a plasma generating portion having an upper face having a smaller area than a lower face thereof wherein the upper faces is flat and an angle between the side faces of the plasma generating portion and a normal to the upper face having an angle more than 5 degrees and wherein the ration of the height of the plasma generating position to the radius of the upper face may be equal or less than one. Yoshioka et al (US Patent No. 6,034,346) (Fig. 3b); Cui et al (US Patent No. 5,965,463) (Figs. 2-3); Murugesh et al (US Patent No. 5,811,356) (Fig. 1); Nowak et al (US Patent No. 5,865,896) (Fig. 1); Yin et al (US Patent No. 5,540,824) (Fig. 2D); Ye et al (US Patent No. 6,071,372) (Figs. 4E, 4F); and Horioka et al (US Patent No. 6,132,551). Collins (US Patent No. 6,036,878) disclose the employment of a Faraday shield in different location of a plasma processing chamber.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Parviz Hassanzadeh whose telephone number is (703)308-2050. The examiner can normally be reached on Tuesday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory L. Mills can be reached on (703)308-1633. The fax phone numbers for the organization where this application or proceeding is assigned are (703)872-9310 for regular communications and (703)872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-0661.

P. Hassanzadeh

Parviz Hassanzadeh
Examiner
Art Unit 1763

November 8, 2002